Pak. J. Bot., 41(3): 1091-1106, 2009.

AN INVESTIGATION OF DIVERSITY, DISTRIBUTION AND MONITORING ON POACEAE (GRAMINEAE) SPECIES GROWING NATURALLY IN BILECIK PROVINCE AT THE INTERSECTION OF THREE PHYTOGEOGRAPHICAL REGIONS (NORTHWEST ANATOLIA – TURKEY)

ATİLA OCAK[1], CENGİZ TÜRE[*2], A. BARAN ŞENMERDAN[1] AND HARUN BÖCÜK[2]

[1]*Department of Biology, Faculty of Sciences and Arts, Osmangazi University, Eskişehir, Turkey*
[2]*Department of Biology, Faculty of Sciences, Anadolu University, Eskişehir-Turkey.*

Abstract

Anatolia is located at the intersection of two important gene centers like Mediterranean and Near East, and in the ninth order among all continental countries in terms of biodiversity. In this study, plant diversity of Poaceae (Gramineae) species distributed naturally on steppe, forest, shrub and wetland vegetations under antropogenic effects in Bilecik (Turkey) were investigated. According to the Davis' grid system, the research area is situated in the A2, A3, B2, B3 squares and at the intersection of three phytogeograpical regions (Irano-Turanian, Mediterranean, Euro-Siberian) in Turkey. During the study, 90 plant taxa belonging to 49 genera were determined. Genera which have the highest number of plant species in the research area are *Bromus* 6, *Aegilops* 6, *Phleum* 6, *Avena* 5, *Poa* 4, *Polypogon*, *Lolium*, *Vulpia*, *Stipa*, *Alopecurus* and *Melica*. Phytogeographical elements represented in the study area are Euro-Siberian 13 (14.4%), Mediterranean 11 (12.2%), Irano-Turanian 5 (5.5%). Spectrum of life form is Hemicryptophytes 60%, Therophytes 27.7%, Geophytes 8.8% and Chamaephytes 3.3%. One species is endemic for Turkey.

Introduction

Anatolia, a connection between Asia and Europe, has climatic factor diversity, different soil types, topographic and geological structures. Therefore, the flora of Turkey is quite rich. Effects of three different phytogeographical regions (Irano-Turanian, Mediterranean and Euro-Siberian) and availability of appropriate conditions in Turkey for Irano-Turanian elements coming from east, Mediterranean elements from south, Euro-Siberian elements from north are the main reasons of the floristic richness (Davis, 1975; Zohary, 1973). Besides, Turkey is located at the intersection of two important gene centers like Mediterranean and Near East and in the ninth order among all continental countries in terms of biodiversity. According to Vavilov, natural races of most cereals cultivated as human food grow on steppe ecosystems in Anatolia (Vavilov, 1951; Anon., 2001).

Poaceae (Gramineae), an important part of steppe, forest, shrub and wetland ecosystems, is one of the largest families of flowering plants in the world, with approximately 600 genera and 10.000 species. Members of the family are widespread in all climates and regions. Grasslands, which make up 20% of the world's vegetational coverage, are composed of Poaceae members (Arabacı & Yıldız, 2004; Türe *et al*., 2004) and the family is mostly studied systematically, ecologically and genetically (Hubbard, 1948). Recently, in Turkey, some detailed studies have been carried out about plant diversity and distribution characteristics of Poaceae taxa (Türe *et al*., 1999; Arabacı & Yıldız, 2004; Türe & Böcük, 2007).

[*]Correspondence author E-mail: cture@anadolu.edu.tr, fax: +90 222 320 49 10

It is important to search the Poaceae members specially used in agricultural activities because the gene center of most Poaceae taxa is Southwest Asia and Turkey (Davis, 1985). Therefore, a research center and also a gene bank, one of the most important centers of the world related to Poaceae species, is stated in Turkey (Menemen, İzmir). This center is also accepted as the most important science center for assurance of seed wheat in future in the world (Johnson, 1972). It was reported that the mould resistance genes against the mould damage in wheats in the USA was obtained from the wheats stored in this center in Turkey (Bertrand, 1982).

Main starch source of both human and animals except potato is plant taxa belonging to the family. Some Pocaeae genera which are mostly used in agricultural activities today like *Triticum* L., *Hordeum* L., *Panicum* L. and *Avena* L. were started to sow about 7000 years ago in Central and East Anatolia (Harlon & Zohary, 1966; Türe, 2003a), at the same regions sowing the plants belonging to the genera of *Oryza* L., *Zea* L. and *Secale* L. were started much more later (Charles, 1984). Although the species number belonging to the Poaceae using in agricultural activities seems low, it comes in the first order among the plants using in agricultural activities. Besides the nourishment values, in ecosystems, Poaceae taxa have ecologically important functions like being responsible for the most of the primer productivity, preserving the soil against erosion and getting the soil richer in terms of organic matters. These plants can distribute into different habitats from subalpinic and xerophyte areas to aquatic ecosystems (Clayton & Renvoize, 1986; Türe & Böcük, 2007).

Natural Poaceae members are used as a gene source for their close relatives phylogenetically to achieve economically important new and advanced characteristics (Mennan *et al*., 2003). Hybrid forms obtained from natural populations of *Hordeum vulgare* L., *Aegilops* sp., *Agropyrum elongatum* (Host) P.Beauv. because of their rich protein contents (Reitz, 1976; Olson & Frey, 1987), *Triticum, Elymus* L.*, Avena, Alopecurus* L.*, Agropyrum, Secale* L.*, Eremopyrum* (Ledeb.) Jaub. & Spach because of their tolerance to the environmental conditions are used (Mennan *et al*., 2003). Specially, *Elymus* sp., *Agropyrum elongatum* have a wide tolerance to salinity and *Triticum turgidum* L., *Aegilops squarrosa* L.*, Agropyrum intermedium* (Host) P.Beauv.*, Lophopyrum elongatum* (Host) Love show resistance to drought (Farooq *et al*., 1994; Wynjones *et al*., 1984, Ebrahemzadeh *et al*., 2000) and *Catapodium rigidum* (L.) C.E. Hubbard ex Dony var. *rigidum* shows resistance to boron toxicity (Türe & Bell, 2004). Except some Poaceae taxa using in perfume sector (Clayton & Renvoize, 1986), some *Lolium* L. taxa are also used to produce paper, flavor, fibers and board (MDF) (Anon., 2002). Moreover, some Poaceae members are used for their genetic characteristics like*, Aegilops bicornis* (Forsskal) Jaub. & Spach*, Agropyrum elongatum*, *Agropyrum intermedium* (Host) P.Beauv. (Anon., 1972), *Triticum diccocum* Schübler*, Triticum monococum* L.*, Triticum timophaevi* Zhuk.*, Agropyrum glaucum* Desf. (Parlevliet, 1981; Zitelli, 1974) showing quite resistance to rust and diseases.

Genetically modified 96 different wheat races have been used in agricultural activities for the last 30 years in Turkey. But *Tritium monococcum* and *Triticum dicoccum*, natural races of the region, is about to be extinct because of not using for agricultural aim any longer (Anon., 2001; Türe & Böcük, 2007). Seed production methods in modern agriculture cause to obstruct the evolutionary adaptation capability of some plants against ecological difficulties and the effects of herbivory and plant parasites (Kışlalıoğlu & Berkes 1987). Moreover, it was reported that these genetically modified wheats could show resistance nearly five years against plant diseases. After this period,

they needed new genes to grow healthy. Therefore, the easiest and the most reliable way to protect the future of agricultural plants is to determine the natural race diversity and distributions, and to protect them by using *in situ* or *ex-situ* methods (Lappe & Collins, 1972; Kışlalıoğlu & Berkes, 1994).

Because of increasing industrial, tourism, agricultural and mining activities, urbanization and overgrazing, the natural structures of forest, shrub, steppe and wetland ecosystems have been destroyed. So, growth of Poaceae members has been obstructed and the natural distribution areas of them have been getting limited under the environmental pressure (Mishra & Rawat, 1998; Ghazanfar, 1998; Ojeda *et al*., 2000; Victor & Dold, 2003).

Except the known characteristics, in future, some Poaceae members may have potential usage in different areas. So, it is important to know and conserve the plant species. In the present study, Poaceae diversity and their natural distribution characteristics in Bilecik were tried to determine. Selecting of Bilecik as one of the prior development regions by government makes it easy to assign fields for human activities. Therefore, it is thought that this study will be a database to monitor the changes in Poaceae diversity and distribution in Bilecik because of possible natural ecosystem damage in future.

Brief description of the study area: Bilecik is located at the northwest part of Turkey and at the intersection of Marmara, Black Sea, Aegean and Central Anatolia regions (N 39^0 $39^{'}$ and 40^0 $31^{'}$ E 29^0 $43^{'}$ and 30^0 $40^{'}$). It is surrounded by Sakarya (Adapazarı) on the north, Bolu on the east, Eskişehir on the southeast, Kütahya on the south (Fig. 1).

Bilecik covers 0.5% (4321 km^2) of total coverage of Turkey. According to Davis' Grid System, it is stated in A2, A3, B2 and B3 squares and the effects of three phytogeographical regions (Irano-Turanian, Euro-Siberian and Mediterranean) can be shown in the area. The research area is a plateau surrounded by deep valleys and its altitude changes between 200 and 1500 m. 60% of total coverage of Bilecik is formed by plateaus, 32% mountains and 8% plains (Anon., 1981-1984; Türe & Böcük, 2000).

Geological structure of the area is mainly composed of metamorphic rocks, limestone and schist originated from mainly Paleozoic era. Among the major formations in the area, the metamorphic ones, known as Bozüyük metamorphic rocks increasingly extend from northwest to the south. Second important formation is upper-late Jurassic Bilecik limestones (Atalay, 1998; Ocak & Tokur, 2004; Türe *et al*., 2005).

Brown and red-brown soils are widespread in the area while alluvial and colluvial soils are restricted into small areas (Türe & Böcük, 2000). Climate of the research area was examined using data from the meteorology station in Bilecik. It shows a transition characteristics between terrestrial climate of Central Anatolia and mild climate of Marmara Region. Annual mean temperature of the city is 12,3 ^oC, annual mean precipitation is 436.4 mm.

When the area is evaluated according to precipitation regime, it shows the characteristics of East Mediterranean Precipitation Regime Type 1 (WSpFS). When the meteorological data is considered according to Emberger formula, it can be seen that the study area is in semi-dry Mediterranean bioclimate zone (Table 1), (Table 2) (Akman, 1990; Anon., 1995). Dry period of Bilecik is between May-September period according to Walter method (Fig. 2).

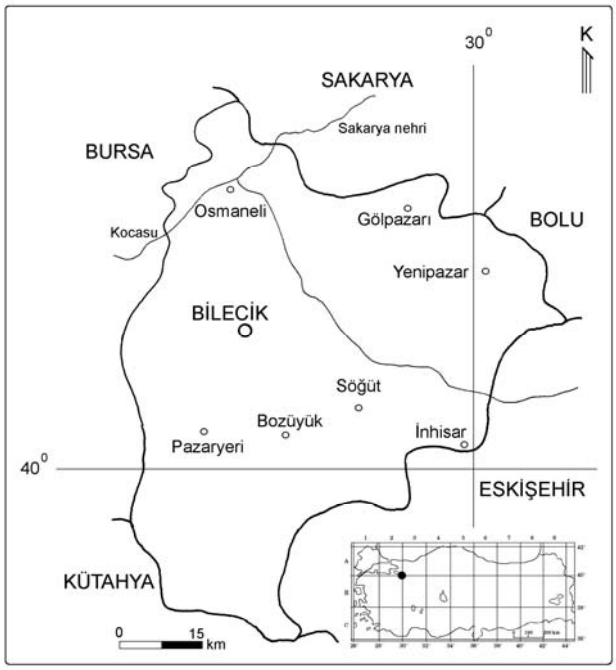


Fig. 1. Location of the study area

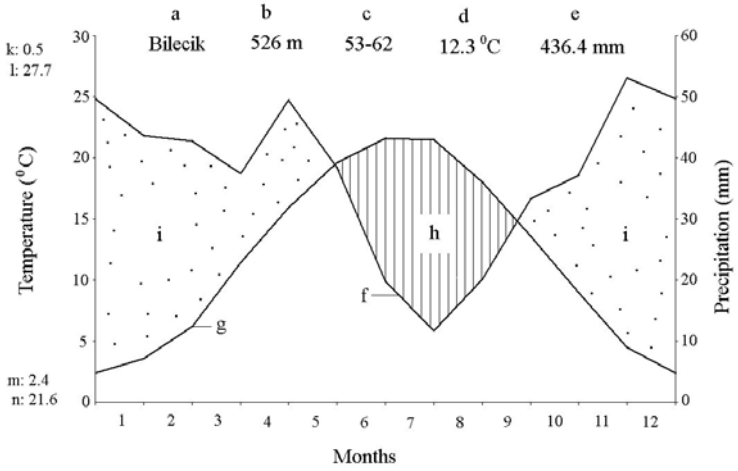


Fig. 2. Ombrothermic diagram of Bilecik

(**a:** City name, **b:** Altitude, **c:** Temperature and observation year number **d:** Mean annual temperature, **e:** Mean annual precipitation, **f:** Mean monthly temperature curve, **g:** Mean monthly precipitation curve, **h:** Dry period, **i:** Rainy period, **k:** Minumum temperature of the coldest month, **l:** Annual absolute minumum temperature, **m:** Absolute maximum temperature, **n:** Maximum temperature of the hottest month)

Table 1. Bioclimate zone of the study area according to Emberger formula (1952).

Station	Altitude	P	PE	M	m	S	Q	Bioclimate zone
Bilecik	526 m	436.4	69.9	27.7	-0.5	2.5	55.9	Semi-dry Medit.

(**P**: Annual average precipitation (mm/m^2), **PE**: Annual summer precipitation mm/m^2), **M**: Average temperature of the hottest month (^{0}C), **m**: Average temperature of the coldest month (^{0}C), **S**: Value of dry season (PE/M), **Q**: Comparison of temperature-precipitation (2000.P.(M+m+546,4) . (M-m))

Table 2. Annual mean precipitation according to seasons and precipitation regime types according to data obtained from Bilecik Meteorology Station (mm).

	Spring (Sp)	Summer (S)	Fall (F)	Winter (W)	Annual	Precipitation regime Type 1
Bilecik	129.5	69.9	90.6	146.4	436.4	W.Sp.F.S.

Vegetation of the area is represented with 4 different vegetation types like forest, shrub, meadow and wetland vegetations. Dominant vegetation types are forest and shrub. Associations forming these vegetation types in the north-west part of the study area belong to Querco-Fagatea (Br-Bl & Vliger, 1937) Fuk. & Fab. 1968 classis syntaxonomically, in the south and south-west parts of the area belong to Quercetea pubescentis (Ober, 1948) Doing. Kraft 1955 classis, in north and north-west parts of the area belong to Quercetea ilicis Br-Bl 1942 classis (Türe & Tokur, 2000; Ocak & Tokur, 2000; Türe, 2001; Ocak & Tokur, 2004, Türe *et al*., 2005).

Material and Methods

Materials of the present study were the plant taxa belonging to Poaceae collected during the field studies in Bilecik and other studies carried out in the region until now (Davis, 1985; Ocak & Tokur, 2000; Türe & Tokur, 2000; Koyuncu, 1999; Tire, 2002).

The herbaria of Middle East Technical University, Ankara University and Gazi University were used for checking of the plant materials. Flora of Turkey and the East Aegean Islands and other sources were used for identification (Davis, 1985; Güner *et al*., 2000; Heywood, 1963-1980; Doğan, 1991; Doğan, 1999). The Poaceae samples were also either identified or checked by Prof. Dr. Musa Doğan (Middle East Technical University).

Author names of the plant species were checked according to Brummit & Powell (1992). The plant taxa distributing naturally in the study area are showed on a coordinated map with the information related to scientific names of the taxa, phytogeographical characteristics, endemism and life forms to know the distribution localities and monitor them easily. Abbreviations were used to indicate the phytogeographical regions of each taxa if known and life forms: Irano-Turanian as Ir.-Tur., Euro-Siberian as Euro.-Sib., Mediterranean as Medit., East Mediterranean as E.Medit. and Endemic as End., Chamaephytes as Ch., Hemicryptophytes as H., Terophytes as T. and Geophytes as G.

Results and Discussion

Bilecik, the northwest part of Turkey, is located at the intersection of Marmara, Black Sea, Aegean and Central Anatolia regions, and of three phytogeographical areas in Turkey, Irano-Turanian, Mediterranean and Euro-Siberian, (Türe & Tokur, 2000; Ocak & Tokur, 2000; Türe, 2001; Tire, 2002). Climatic properties, a transition climate type between terrestrial climate of Central Anatolia and mild climate of Marmara region, and topographic structure of the area let some indicator plant taxa ~~of~~ for Mediterranean region

like *Pinus brutia* Ten.*, Quercus cocciferae* L.*, Arbutus andrachne* L.*, Daphne pontica* L. grow in low altitudes. Presence of some plant taxa in the northwest part of the study area like *Fagus orientalis* Lipsky*, Pinus sylvestris* L.*, Carpinus betulus* L.*, Quercus cerris* L. var. *cerris*, *Abies nordmanniana* (Stev.) Spach subsp. *bornmuelleriana* (Mattf.) Coode & Cullen shows that the area is under the influence of Euxine province (Zohary, 1974; Türe & Tokur, 2000; Türe *et al.*, 2005), in the south and east part of the area, plant species like *Quercus pubescens* Willd.*, Juniperus excelsa* Bieb.*, Juniperus foetidissima* Willd.*, Juniperus oxycedrus* L. subsp. *oxycedrus* show that these parts of area are under the effect of Irano-Turanian phytogeographical regions (Akman, 1993; Türe *et al*., 2005; Türe, 2001).

Being under different ecological conditions because of its geographical location, the study area supports the distribution of different vegetation types and floristic elements. This situation was also reported by the studies carried out in the region before. According to these studies, plant taxa determined in the area belongs to different syntaxonomic classis like Querco-Fagatea, Quercetea pubescentis and Querceta ilicis (Akman, 1995; Türe, 2001; Türe *et al*., 2005; Ocak & Tokur, 2004).

Most plant taxa distributing in the study area, under the effect of Anatolian forests and Central Anatolian steppes, belongs to Poaceae family (Çetik, 1985). At the end of the studies, in the research area, 90 plant taxa belonging to 49 genera were determined. It is thought that this number can increase when new studies are carried out in the future. The number of genera determined in the research area (49 genera) forms 36% of total Poaceae genera (136 genera) in Turkey (Davis 1985). When similar studies are considered in Turkey, it can be seen that 47 genera in Malatya (East Anatolia) and 56 genera in Eskişehir (Central Anatolia) were reported. Table 3 summarizes the genera which have the highest number of species and comparison with the other studies. According to the table, *Bromus* L. and *Aegilops* show similarity in all areas in terms of species number. Besides, in terms of genus *Phleum* L., there is a similarity with the species number in Eskişehir (Türe & Böcük, 2007; Arabacı & Yıldız, 2004).

When the number of Poaceae taxa determined in the area (90) is compared with the number of total Poaceae taxa (520 taxa) in Turkey, nearly 17.3% of total Poaceae taxa are represented in Bilecik. This ratio was reported as 20.7% (105 taxa) in Eskişehir, 19.4% (101 taxa) in Malatya (Türe & Böcük, 2007; Arabacı & Yıldız, 2004).

Distribution of plant taxa determined in the area according to phytogeographical regions are given in Table 4. Euro-Siberian elements are dominant (14.4%) and it is followed by Mediterranean (12.2%) and Irano-Turanian elements (5%). These results are also similar with the other general floristical and vegetational studies in the region (Koyuncu, 1999; Türe & Tokur, 2000; Ocak & Tokur, 2000; Türe *et al.,* 2005). Dominancy of Euro-Siberian elements in the area is because of the geographical position of the area and the effects of Euxine province. When Table 4 is considered, the results of the present study is similar to Black Sea region because of having more Euro-Siberian elements, also similar to Eskişehir because of very close geographic location, long common border and is not similar because of having more Mediterranean elements. Malatya province is far away the Mediterranean effect and is under the Irano-Turanian effect, so Irano-Turanian elements are dominant in the province (Türe & Böcük, 2007; Arabacı & Yıldız, 2004).

Table 3. Genera which have the highest number of plant species and comparison with other studies.

Genus	Central Anatolia (Eskişehir, Türe 2005)	East Anatolia (Malatya, Arabacı and Yıldız, 2004)	North-West Anatolia (Bilecik, present study)
Bromus	9	10	6
Aegilops	8	6	6
Hordeum	3	5	4
Alopecurus	3	4	3
Poa	7	4	4
Phleum	6	3	6
Stipa	6	4	3
Lolium	2	3	3

Table 4. Distribution of the plant taxa determined in the study area according to phytogeographical regions.

Phytogeographical regions	Central Anatolia Eskişehir Türe and Böcük 2007		East Anatolia Malatya Arabacı and Yıldız 2004		Northwest Anatolia Bilecik present study	
	Number	%	Number	%	Number	%
Irano-Turanian	15	14.2	29	28.7	5	5.5
Euro-Siberian	21	20	6	5.9	13	14.4
Mediterranean	6	5.7	9	8.9	11	12.2

Of 30% of total plants and 14% (77) of total Poaceae taxa in Turkey are endemic (Davis 1985). Poaceae taxa contributes nearly 2% to endemism ratio of Turkey (Türe & Böcük, 2007). When the endemic plant distribution in Turkey is considered, it can be seen that the areas under the effects of Irano-Turanian phytogeographical region have the highest number of endemic taxa, and it is followed by the areas under the effects of Mediterranean and Euro-Siberian phytogeographical regions. It is possible to explain this situation by topographic structure of Turkey and the effects of geological eras (Seçmen *et al*., 1986; Türe & Tokur, 2000; Türker & Güner, 2003). Only one Poaceae taxon (*Festuca callieri* (Hackel ex St.-Yves) F.Markgraf subsp. *callieri*) determined in the area is endemic for Turkey. The reason of low endemism ratio is thought that because of having low contribution of Turkey's endemism ratio and many areas are under the effect of Euro-Siberian phytogeographic region.

Risk categories of the plant taxa determined in the area were checked according to Red Data Book of Turkish Plants (Ekim *et al*., 2006). No taxon was under risk. It is thought the reason of this is because of having wide tolerance and protecting these plants in forest ecosystem by forest staff. Besides, topographic structure of the region is not suitable for agricultural activities. But Bilecik city is prior development regions. This situation makes it easy to assign fields for industrial, mining and building activities. Therefore, it is possible to face loss in Poaceae diversity in future. The present study presents monitoring oppurtunity for the risk situation of the plant taxa determined in the research area in the future.

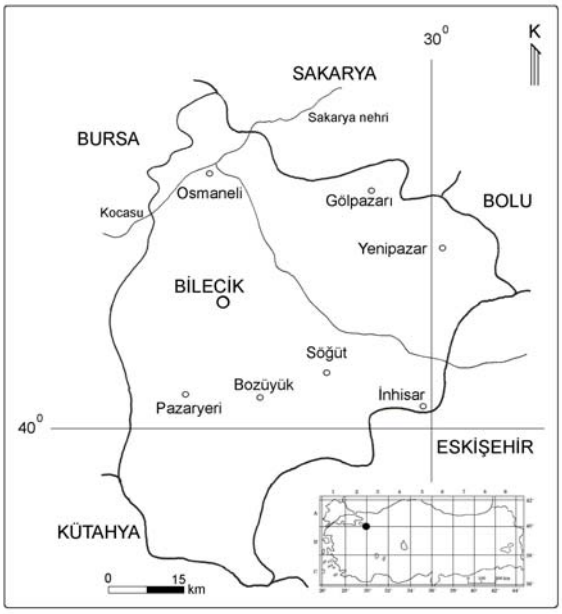
Table 5 summarizes the life form of the plant taxa determined in the research area according to Raunkiaer (1934) (Akman & Ketenoğlu, 1992). Hemicryptophytes take place in the first order with 60%, it is followed by terophytes with 27.7%, geophytes with 8.8% and chamaephytes with 3.3%. It is thought that producing many seeds and presence many individuals in the area for therophytes and having productive underground parts for hemicriptophytes have important roles in their distribution (Floret *et al*., 1990; Keshet *et al*., 1990; Türe, 2003b).

Table 5. Life forms of the plant taxa determined in the research area.

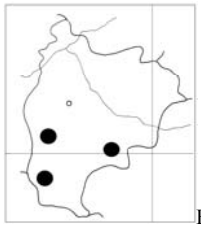
Life form	Taxa number	%
Therophyte	25	27.7
Geophyte	8	8.8
Chamaephyte	3	3.3
Hamicryptophyte	54	60

Recently, many plant taxa become extinct or natural distribution areas of their populations are getting narrower (Çepel, 1997). In this study, species and habitat diversity of Poaceae, economically and ecologically important group, were tried to determine (Fig. 3). It is thought that the present study will help the researchers to monitor the Poaceae diversity in future and to protect the biodiversity and gene sources of the region.

Fig. 3. Plant list and distribution maps of the poaceae species in bilecik.

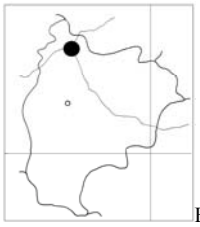


Brachyopodium sylvaticum (Huds.) P.Beauv.



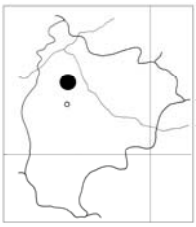
Euro.-Sib., H.

Brachyopodium pinnatum (L.) P. Beauv.



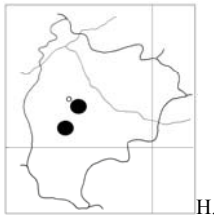
Euro.-Sib., H.

Trachynıa distachya (L.) Link.



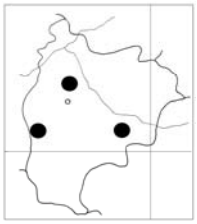
Medit., T.

Agropyron cristatum (L.) Gaertn. subsp. *pectinatum* (Bieberd.) Tzvelev var. *Pectinatum*



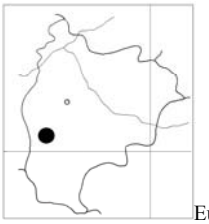
H.

Aegilops umbellulata Zhuk.



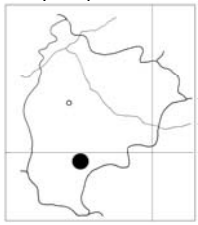
Ir.-Tur., T.

Hordeum geniculatum All.



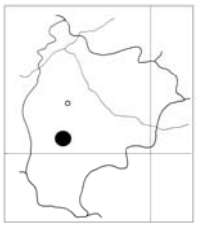
Euro.-Sib., H.

Elymus hispidus (Opiz) Melderis subsp. *hispidus*



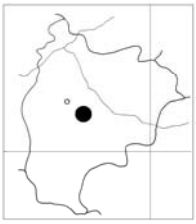
Ir.-Tur., H.

Aegilops triuncialis L. subsp. *triuncialis*



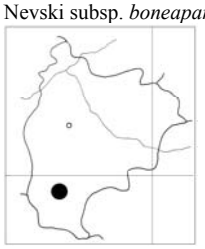
T.

Hordeum murinum L.



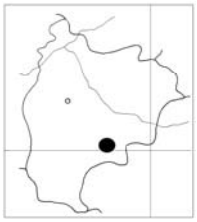
H.

Eremepyrum boneapartis (Spreng.) Nevski subsp. *boneapartis*



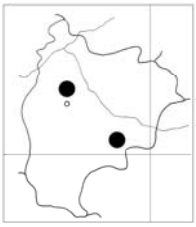
Ir.-Tur., H.

Aegilops biuncialis Vis



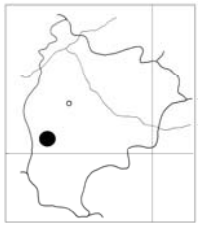
T.

Hordeum bulbosum L.



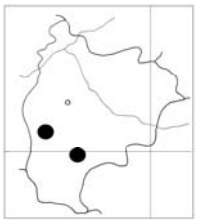
H.

Aegilops margrafii (Greuter) Hammer



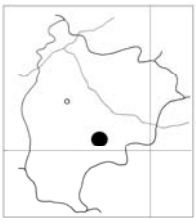
Medit., T.

Aegilops geniculata Roth.



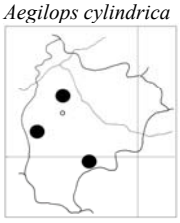
Medit., T.

Hordeum distichon L.



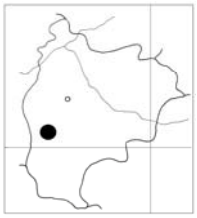
H.

Aegilops cylindrica Host. Gramm



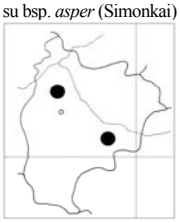
Ir.-Tur., T.

Triticum aestivum L.



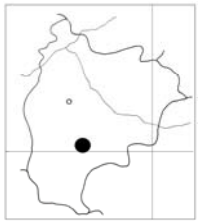
T.

Taenatherum caput-medusae (L.) Nevski su bsp. *asper* (Simonkai) Melderis



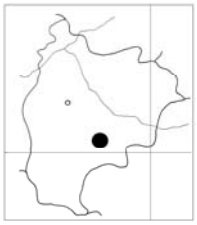
T.

Bromus hordeaceus L.



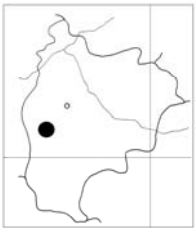
Medit., T.

Bromus tomentellus Boiss.



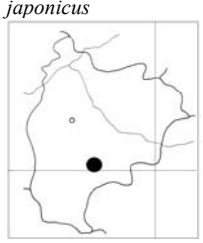
Ir.-Tur., T.

Avena sativa L.



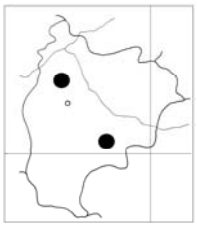
T.

Bromus japonicus Thunp. subsp. *japonicus*



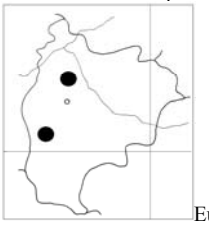
T.

Avena barbata Pott subsp. *barbata*



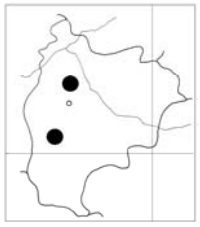
Medit., T.

Arrhenatherum elatius (L.) P. Beauv. ex J. et C. Presl subsp. *elatius*



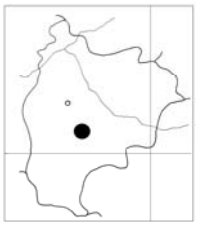
Euro.-Sib., H.

Bromus tectorum L.



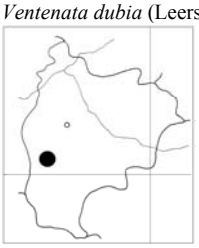
T.

Avena wisteii Steud.



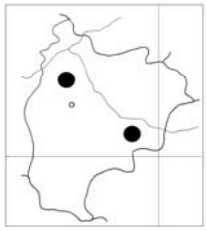
T.

Ventenata dubia (Leers) Coss.



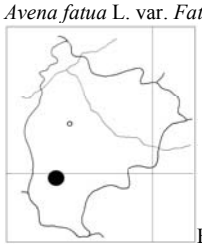
H.

Bromus sterilis L.



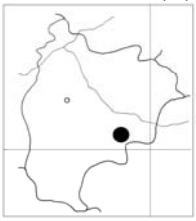
T.

Avena fatua L. var. *Fatua*



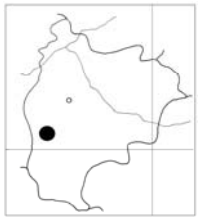
Euro.-Sib., T.

Rostraria cristata (L.) var *cristata*



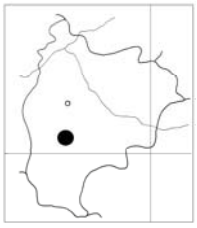
H.

Bromus rubens L.



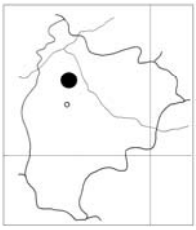
T.

Avena sterilis L.



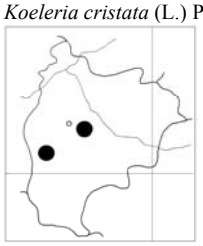
T.

Koeleria nitidula Velen



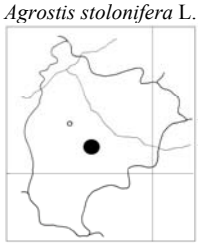
G.

Koeleria cristata (L.) Pers.



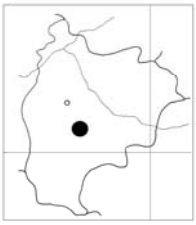
H.

Agrostis stolonifera L.



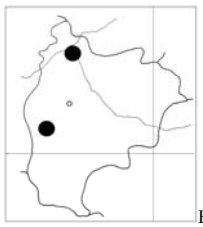
G.

Milium vernale Bieb. subsp. *vernale*



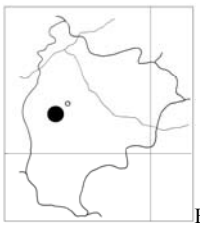
H.

Holcus lanatus L.



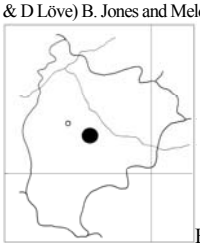
Euro.-Sib.., H.

Polypogon viridis L.



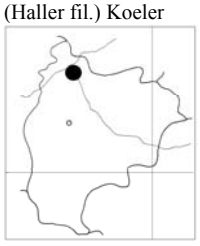
Euro.-Sib., H.

Anthoxanthum odoratum subsp. *alpinum* (A & D Löve) B. Jones and Melderis



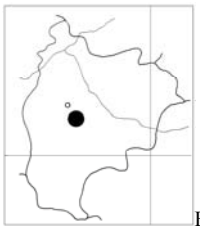
Euro.-Sib., H.

Calamagrostis pseudaphragmites (Haller fil.) Koeler



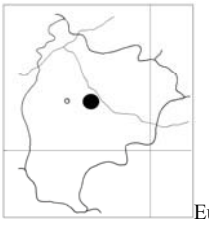
G.

Polypogon maritimus Wild. subsp. *maritimus*



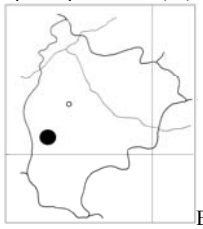
Euro.-Sib., H.

Aleopecurus aequalis Sobol.



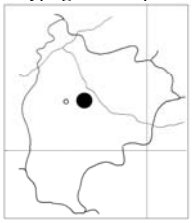
Euro.-Sib., G.

Apera spica-venti (L.) P. Beauv



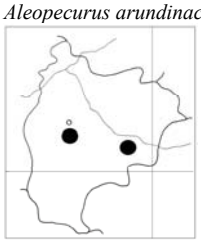
Euro.-Sib.., H.

Polypogon monspeliensis L.



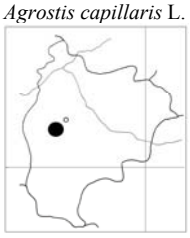
H.

Aleopecurus arundinaceus Poiret.



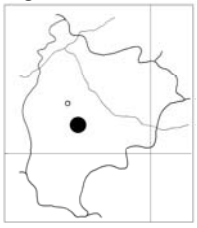
G.

Agrostis capillaris L. var *capillaris*



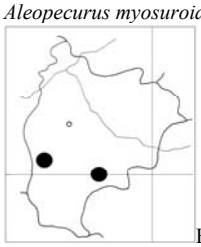
H.

Lagurus ovatus L.



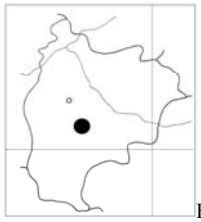
Medit., H.

Aleopecurus myosuroides Huds.



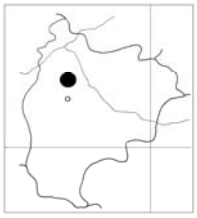
Euro.-Sib., G.

Phleum alpinum L.



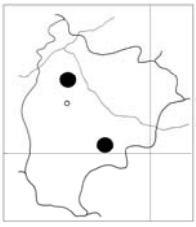
Euro.-Sib., H.

Phleum exeratum Hochst.



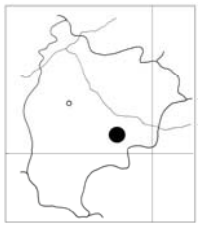
Medit., T.

Lolium temulentum L. var. *temulentum*



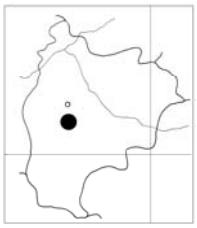
T.

Phleum pratense L.



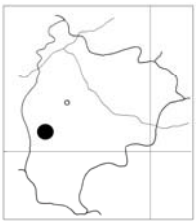
H.

Festuca valesiaca Scheich. var. *valesiaca*



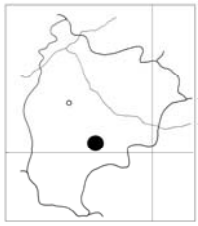
H.

Vulpia myuros (L.) C.C. Gmelin



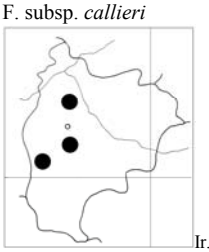
H.

Phleum bertolonii DC.



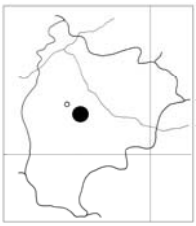
H.

Festuca callieri (Heck ex st.Yves) F. subsp. *callieri*



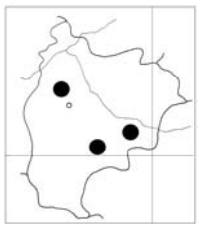
Ir.-Tur., H., End.

Vulpia ciliata Dumort



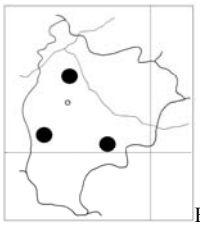
H.

Phleum montanum C.Koch subsp. *Montanum*



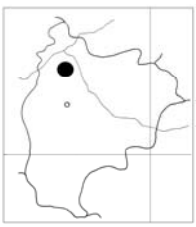
H.

Lolium perenne L.



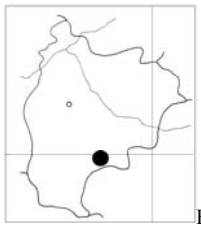
Euro.-Sib., H.

Vulpia unilateralis L.



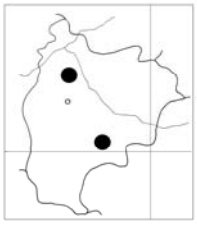
H.

Phleum phleoides (L.) Karst.



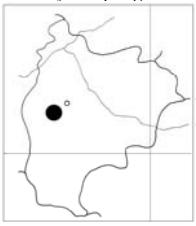
Euro.-Sib., H.

Lolium multiflorum Lam.



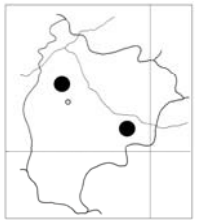
H.

Catapodium rigidum (L.) C.E. Hubbard ex Dony subsp. *rigidum* var. *rigidum*



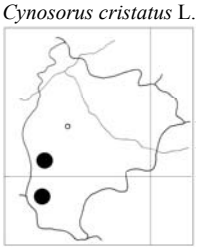
H.

Poa trivialis L.



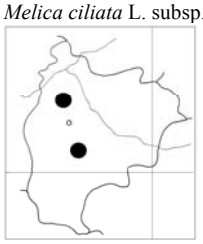
H.

Cynosorus cristatus L.



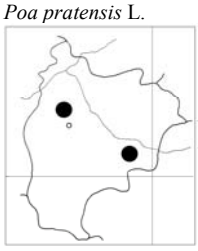
Euro.-Sib., T.

Melica ciliata L. subsp. *ciliata*



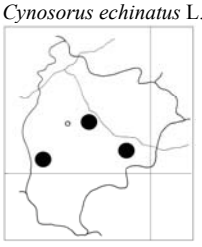
Ir.-Tur., H.

Poa pratensis L.



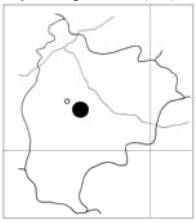
G.

Cynosorus echinatus L.



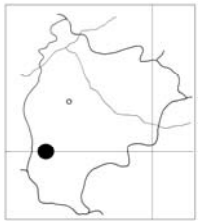
Medit., H.

Glycera plicata (Fr.) Fr.



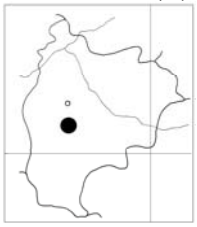
H.

Poa memoralis L.



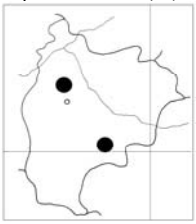
H.

Lamarckia aurea (L.) Moench



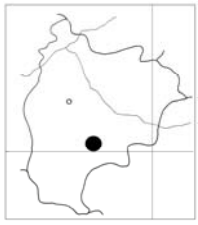
Medit., H.

Stipa bromoides (L.) Dörf.



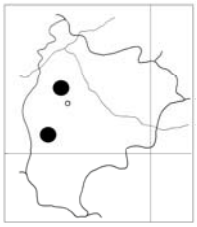
Medit., Ch.

Poa bulbosa L.



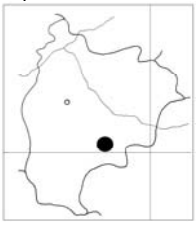
H.

Briza media L.



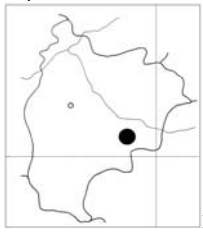
H.

Stipa arabica Trin & Rupr



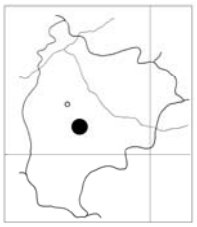
Ir.-Tur., Ch.

Dactylis glomerata L. subsp. *hispanica* L.



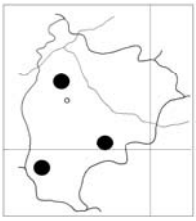
Euro.-Sib., H.

Echinaria capitata (L.) Desf.



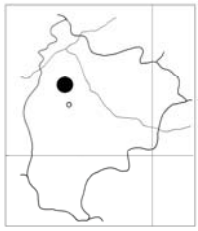
T.

Stipa lessingiana Trin & Rupr



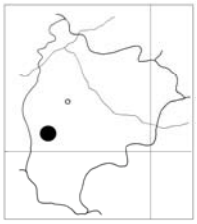
Ch.

Piptatherum cocrulescens (Desf.) P. Beauv



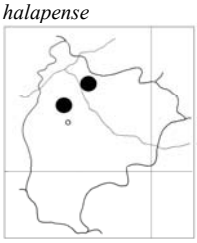
H.

Digitaria sanguinalis (L.) Scop



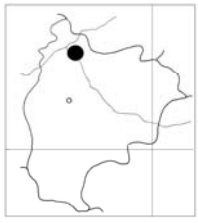
H.

Sorghum halapense (L.) Pers var. *halapense*



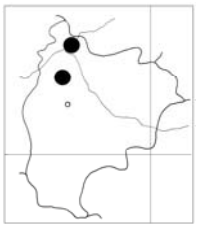
G.

Phragmites australis (Cav.) Trin. ex Steud.



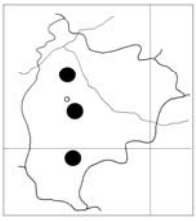
T.

Setaria viridis (L.) P. Beauv



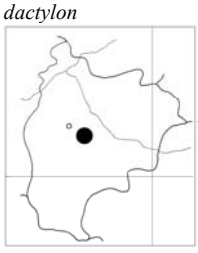
T.

Chrysopogon gryllus (L.) Trin



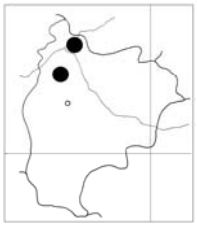
H.

Cynodon dactylon (L.) Pers var. *dactylon*



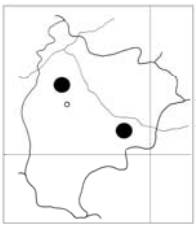
H.

Setaria verticillata (L.) P. Beauv var. *verticillata*



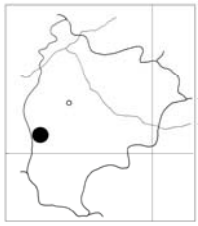
T.

Botriochloa ischaemum (L.) Keng



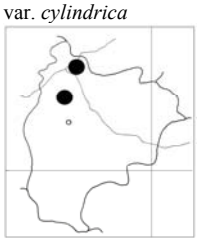
H.

Echinochloa crus-galli (L.) P. Beauv



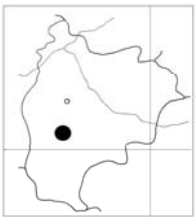
H.

Imperata cylindrica (L.) Raeusch. var. *cylindrica*



G.

Zea mays L.



T.

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(Received for publication 5 September 2005)